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Thermochimica Acta 256 (1995) 175–183

thermochimica acta

Heat effects and water sorption by human serum albumin on its suspension in water–dimethyl sulphoxide mixtures

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Received 12 October 1994; accepted 28 October 1994

Abstract

The heat effects on suspending solid human serum albumin (HSA) in various water–dimethyl sulphoxide (DMSO) mixtures were measured calorimetrically at 298 K. The isotherm of the water sorption for HSA suspended in the water–DMSO mixtures was also measured. The recording of the calorimetric heat effects exhibits endothermic and exothermic peaks. The endothermic heat effects were estimated graphically from the calorimetric curves. These values are shown to obey the Langmuir isotherm of the water sorption. The quasi-thermodynamic constant of water adsorption (1.2 ± 0.3 M^{-1}) and the monolayer formation energy (-20.1 ± 1.0 J g^{-1}) were estimated from the calorimetric data with the Langmuir model. The adsorption constant (0.16 ± 0.08 M^{-1}) was evaluated from fitting the water sorption isotherm by the Langmuir model also. There is a divergence between the latter constant and the adsorption constant obtained from the calorimetric data. It appears that the processes accompanying the exothermic heat evolution influence the HSA's ability to bind water. The surface area of the water monolayer was also calculated from the fitting of the water sorption isotherm. It essentially exceeds the recognised values for proteins estimated from the data for water vapour sorption. The aqueous solubility of the protein after the exposure of the HSA preparation in the water–DMSO mixtures is also essentially decreased. Hence, changes in the protein–protein interactions of a diverse nature might accompany the exothermic heat evolution on suspending HSA in water–DMSO mixtures.

Keywords: Dimethyl sulphoxide; Human serum albumin; Sorption; Thermodynamics; Water

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SSDI 0040-6031(94)02162-7